

FIGHT'S N!

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International Warfighters Train with Distributed Mission Operations Research Capabilities

Active duty, Air Force Reserve Command (AFRC), and Air National Guard (ANG) F-16 pilots flew Coalition Mission Training Research (CMTR) Exercise Battle Buzzard (EBB) scenarios with Royal Air Force (RAF) warfighters in October 2006. The Air Force Research Laboratory (AFRL) Warfighter Readiness Research Division at Mesa Research Site AZ (AFRL Mesa) hosted the USAF fighter pilots and RAF Airborne Warning and Control System (AWACS) controllers in the Distributed Mission Operations (DMO) Testbed for the weeklong event.

From the DMO Testbed in AFRL Mesa, F-16 pilots from the 466th FS, Hill AFB UT, flew the Viper four-ship of simulators while three controllers from RAF Waddington provided command and control (C2) support from the AWACS Block 30/35 consoles and Tactical Display Framework. An F-16 pilot from the 134th FS, Burlington VT ANG, flew one of the Experimental-Deployable Tactics Trainers (X-DTT) and served as the Forward Air Controller-Airborne

(FAC-A), coordinating air strikes by the Viper pilots and GR4 aircrew linked into EBB from Tornado simulators at RAF

successful integration of a variety of DMO-capable systems (e.g., RAF air-to-ground GR4s, RAF ground FACs, F-16s,

AWACS, White Force, adversary air and surface forces) and distributed mission planning, after action reviews, and performance assessment methods represents a significant step forward in CMTR exercise capabilities.

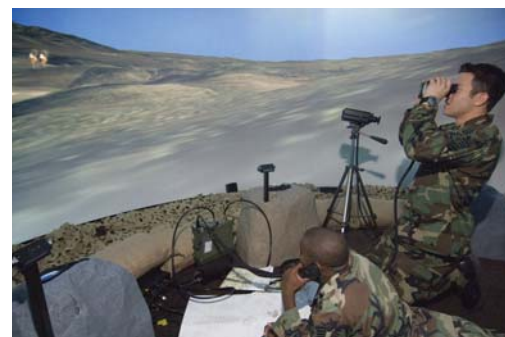
Operational aircrew at RAF Waddington rotated mission commander duties with the operational F-16 pilots at AFRL Mesa.



The EBB team comprised of DMO Testbed software, hardware, technical engineers, and subject-matter experts, F-16 pilots from Hill AFB and Burlington VT, AWACS controllers from RAF Waddington, the UK CCD team, Australian and Canadian scientists, and AFRL Mesa military and government scientists

Waddington where RAF ground FACs operated in their synthetic environment.

The CMTR goal is to develop, demonstrate, and evaluate innovative engineering and research methods for large scale, multinational distributed training and mission rehearsal via classified networked systems developed as part of the collaboration with Canada and the UK. EBB tied simulation systems in the DMO Testbed at AFRL Mesa with the Aircrew Battlespace Training Centre at RAF Waddington. The



Inside the JTAC TRS dome, front-line JTACs called in EBB air strikes (2 targets burning in background) while networked to the FAC-A, F-16s, and GR4s from a separate Testbed at AFRL Mesa. JTACs employed field equipment such as the PRC radio, laser range finder, and binoculars



An AFRL Mesa team lead observed AWACS controllers from RAF Waddington as they conducted EBB missions from AWACS Block 30/35 consoles (left) and the PC-based Tactical Display Framework stations (right)

With virtual and constructive entities augmenting the DMO mix, the RAF and USAF warfighters executed Offensive Counter Air (OCA) and Close Air Support missions over the National Training Center (NTC) database near Ft Irwin CA. Tailored research scenarios guaranteed EBB warfighters met their training objectives and scientists obtained R&D data for evaluation as the level of difficulty rose to include real time airspace deconfliction, realistic dynamic retasking of assets, time sensitive targeting, Defensive Counter Air (DCA), and retro-

grade operations to protect high value assets.

EBB also marked the first CMTR demonstration of AFRL Mesa's Joint Terminal Attack Control (JTAC) Training and Rehearsal System (TRS), as operational USAF JTACs directed USAF and RAF warfighters to NTC targets. The ground-based JTACs, RAF ground FACs, and USAF FAC-A identified adversary missile plat-

forms and ground force movements to orchestrate time sensitive violence by the Viper and Tornado warfighters.

The AWACS controllers managed the air war and relayed battle damage assessments to White Force "command authorities" to ensure effective airpower employment. EBB enabled coalition warfighters to delve into C2 processes spanning the Kill Chain. CMTR scientists will analyze decisions made in the heat of battle to enhance ongoing R&D efforts designed to transition the next-generation in mission readiness training capabilities to the Combat Air Forces (CAF).



F-16 pilots flying Viper 4-ship at AFRL Mesa mission plan for an EBB scenario; X-DTT pilot with target area photo served as FAC-A while RAF AWACS controllers provided C2 for F-16, GR4, and ground JTACs

The Division teamed with operational training staff members of Air Combat Command (ACC) and the UK's Capability Concept Demonstration (CCD) team. In addition to the RAF controllers and CCD team, AFRL Mesa hosted observers from the Australia and Canada R&D organizations and the US Army simulation center. These R&D counterparts are analyzing EBB results to include planning for additional international simulation nodes in future CMTR trials.



Training Research Supports USAF 8th and 16th Weapons Squadrons

The USAF Weapons School's (USAFWS) Air Battle Manager (ABM) and Viper pilot instructors participated in AFRL Mesa's DMO training research program with Weapons Instructor Course (WIC) Class 06B. The weeklong tailored research continued data gathering using high-fidelity simulation and competency-based objectives, scenarios, and metrics. Data from WIC weeks support R&D for Mission Essential Competency (MEC) training strategies and impact assessments of different instructional characteristics for teaching the "go-to-war" knowledge, skills and experiences for the CAF.

Through a series of tradespace assessments with different configurations

(visuals, database, computer-generated forces, etc.), DMO Testbed and systems capabilities have improved significantly. Research conducted with USAFWS is critical for determining how best to integrate enduring instructional principles with high-fidelity simulation for day-to-day MEC-driven training and mission rehearsal activities to augment live-fly CAF operations.



USAFWS instructors review WIC mission data prior to "strapping in" to the Viper 4-ship at AFRL Mesa while pilot in Viper 4 has his cockpit off "freeze" to set up his weapon systems

Many DMO Testbed improvements are the direct result of fidelity studies to identify and quantify the impact of differing levels of DCA and OCA mission difficulty. In the first year of an advanced technology development effort, the Division demonstrated “first fight” with two X-DTTs simulating Red Air and flown by 56th Fighter Wing pilots from Luke AFB AZ in support of USAFWS training research. Initial analysis indicates considerable WIC student performance improvement with the virtual Red Air pilots flying in the scenarios.

Division scientists and engineers are documenting how simulation fidelity contributes to the quality of combat training and mission performance, and the X-DTTs are being used in a Performance Effects Related to

Right: Pilots from Luke AFB flew an X-DTT 2-ship as realistic Red Air against WIC pilots at AFRL Mesa, replicating in many respects how the USAFWS employs CAF assets for Adversary Tactics training over the Nevada Test & Training Range (note farms in database and accompanying live-fly photo)



Left: An F-16 Adversary Tactics pilot attempts to simulate Red Air weapons and tactics during live-fly engagements; high-fidelity simulation can augment this training with realism derived from physics-based entities with multiple threat platforms, validated radar cross sections, accurate missile fly-outs, effective defensive measures, and offensive and defensive tactics



Force-cueing Manipulation study to compare with cohort data from warfighters operating in high-fidelity systems. The DMO Testbed is a major R&D medium for scientists to conduct field assessments

for ACC and verify optimal levels of fidelity, maintainability, and affordability for deployable DMO readiness training assets for the CAF.



Collaboration with Team Luke Delivers Advanced Job Aiding Tool

All too often, expert aircraft maintainers can't repeat on the ground problems aircrews report in flight. And when they do find the problem, it's often tough to figure out how to fix it. The Division set out to tap that expertise and leverage it force-wide through the Aircraft Maintenance Intuitive Troubleshooting (AMIT) program and by partnering with the 56th Maintenance Group for field testing at Luke AFB.

The test included two concurrent experiments (an “as is” configuration and a “to be” one) with a total of 72 participants troubleshooting the F-16's Fire Control (FCS) and Electro-Environmental (E&E) systems. The pool of participants was an even mix of system experts, system novices, and experts on unrelated systems. Six test situations were developed and divided into varying discrepancy complexity levels (simple, moderate, and complex) for both specialties (FCS and E&E).

Similar to “lean manufacturing” concepts, AMIT reduced time to perform maintenance processes by 27%, saving two hours in an eight-hour workday.



A 56th Maintenance Group Quality Assurance technician uses the AMIT tool to troubleshoot an F-16 fire control discrepancy (see inset)

Maintainers using the AMIT tool made fewer errors (diagnostic, unnecessary removals, and fewer repeat write-ups)

than maintainers without the tool. Average FCS errors reduced by 16% and E&E system errors an impressive 66%. Through a comparison across experience levels, novice technicians using the AMIT tool consistently performed maintenance tasks an average of 24% faster with 50% fewer errors than experts without AMIT.

By capturing strategic knowledge for other technicians to use, AMIT leaps to the next level of job aiding technology development and promises to be a force-multiplier for maintenance and operations alike. The Division is coordinating the above test results with MAJCOMs and the Air Staff to facilitate technology transition of this concept to the acquisition community to deliver this exciting new capability to the warfighter.



TARGETS OF OPPORTUNITY



An F-16 pilot from the ANG/AFRC Test Center tracked a live F-16 on radar and SADL, and points to the visual image of the jet operating in the Pecos MOA during an LVC test of the DIS-Link-16 gateway between AFRL Mesa and Cannon AFB

✈ Using Human Effectiveness Director's science and technology funding, AFRL Mesa demonstrated technical feasibility of Live, Virtual, and Constructive (LVC) integration by flying a two-ship of the four F-16 Viper simulators located in the DMO Testbed. The Viper two-ship joined with a three-ship of live F-16s from Cannon AFB NM, flying over the Pecos Military Operating Area (MOA). Using secure Link-16 to transmit LVC data, this test shared Distributed Interactive Simulation (DIS) information between the AFRL Mesa simulators and the live aircraft by creating a DIS-Link-16 "gateway" to wrap DIS data with the Joint Tactical Information Distribution System (JTIDS) messages.

By inserting a real time "translator" of JTIDS messages between DMO portals and Link-16 terminals, data was converted to/from DIS protocols, and Radio Frequency transmissions were converted to/from DIS data packets for real-time LVC interaction. Using this technology, the Viper two-ship in the DMO Testbed "joined" the live F-16s over the Pecos MOA database. AFRL Mesa pilots were able to see the three live aircraft visually and on the Situation Awareness Data Link (SADL) display, obtain radar locks, and employ simulated weapons. Enabled by Link-16/SADL architecture, these tests marked the first time simulator pilots flew visually with live aircraft in a real time DMO environment; next tests in 2007.

BRIEFS AND DEBRIEFS

✈ The Division facilitated a C2 Battle Lab initiative from the Johns Hopkins University Applied Physics Laboratory, dubbed the Combined Air and Space Operations Center (CAOC) Performance Assessment System (CPAS). The tool's initial capability was improved and demonstrated at CAOC-Nellis during DMO Virtual Flag and live-fly Red Flag exercises.

CPAS electronically observed CAOC-Nellis mission processes and assessed associated chatroom communications among warfighters in near real time. A CAOC-Nellis instructor confirmed CPAS rendered a 75% reduction in reconstruction and debriefing time, lowering mission completion time for warfighter participants through focused data displays.

CPAS will be used for CAOC-Nellis debriefing exercises. The Division will analyze CPAS data files to develop the embedded piece of CAOC performance measurement assessment. Using focused data and collaborative tools CPAS promises a 50% cut in time required for brief/debrief for C2 team level activities.



USAFWS instructors and WIC students of the 57th Weapons Squadron mission plan at AFRL Mesa prior to flying C-17 tactical sorties from Williams Gateway Airport over the Southwest USA



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